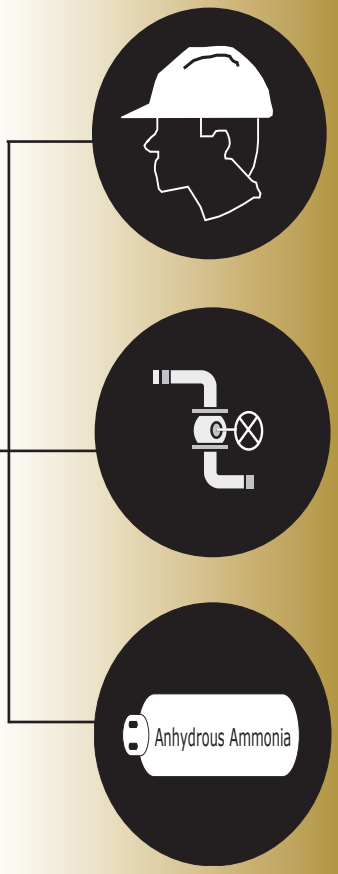
WISHA Department of Labor & Industries

Anhydrous Ammonia



Chapter 296-826
September 2006 Edition

Washington Industrial Safety & Health Act

F414-138-000

09/2006 printing

Department of LABOR AND INDUSTRIES

Standards Update to
Chapter 296-826 WAC, Anhydrous Ammonia

Issue Date 9/2006
Effective Date 9/1/2006

The Department of Labor and Industries has rewritten and reorganized for clarity and ease of use the safety standards for Anhydrous Ammonia. The Department has repealed the rules out of Chapter 296-24 WAC, and adopted them into a separate chapter, Chapter 296-826 WAC.

- **Please discard WAC 296-24-510 through 296-24-51099**

To receive future updates of this standard and all other Department of Labor and Industries safety and health standards electronically, please sign up on the WISHA Listserv (http://www.lni.wa.gov/Safety/Rules/default.htm). By subscribing to the Listserv, you will also receive rule updates, hearing notices, and informational packets for all safety and health rules.

Also available on the WISHA web site:

- WISHA Core Rules
- Other General WISHA Rules
- Industry and Task-specific Rules
- Proposed rules and hearings
- Newly adopted rules and new rule information
- WISHA Regional Directives (WRDs)
- WISHA Interim Operations and Interpretive Memoranda (WIIM)
- Memoranda of Understanding (MOU)

To receive hardcopy updates of this rule, please return the card located at the back of the book.

Anhydrous Ammonia

Chapter 296-826-100 WAC

Other Rules that may apply to your workplace

- The WISHA Safety and Health Core Rules, Chapter 296-800 WAC, contain the basic requirements that apply to most employers in Washington. They also contain:
  - An Introduction that lists important information you should know, including a section on building, fire and electrical codes.
  - A Resource section that includes a complete list of all WISHA rules and a directory of the Labor and Industries (L&I) offices.
- Other WISHA rules may apply to you, depending on the activities and operations of your workplace. Contact your local L&I office if you're uncertain about which WISHA requirements apply to you.
- To go online to access all the Safety and Health Rules: http://www.lni.wa.gov/wisha
- If you would like to receive e-mail notification of rule updates, please register for the Standards Listserv on the WISHA web site at http://www.lni.wa.gov/home/listservs.htm
- For a CD or paper copy contact us by:

Mail: Department of Labor and Industries
P.O. Box 44620
Olympia, WA 98504-4620

Telephone: 1-800-4BE-SAFE (1-800-423-7233)

Administrative Rules

Chapter 296-826 WAC

Quick Reference

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Anhydrous Ammonia

Chapter 296-826-100 WAC

Scope

This chapter applies to employers who use, handle, store, distribute, or transport anhydrous ammonia.

- Operations covered by this chapter include, but aren't limited to:
  - All distributors of anhydrous ammonia, including distributors who store and transport anhydrous ammonia on trucks delivering to a farm.
  - Any employer who stores and handles anhydrous ammonia to use in water treatment plants, acid production, metal processing, pollution control, or make products such as:
    - Fertilizers
    - Synthetic resins
    - Plastics and intermediates
    - Hexamine for explosives
    - Dyes
    - Insecticides
- Operations not covered by this chapter include:
  - The manufacture of anhydrous ammonia.
  - Mechanical refrigeration systems where ammonia is used solely as a refrigerant.
  - Pipelines transporting anhydrous ammonia into or out of a storage facility.
  - Agricultural operations within the scope of chapter 296-307 WAC. When a distributor delivers anhydrous ammonia to a farmer, the requirements for agricultural operations apply:
    - As soon as the farmer takes possession of the truck or equipment containing ammonia from the distributor, this includes the farmer picking up the farm truck or equipment from the distributor.
    - An ammonia distributor begins performing agricultural operations using their ammonia at the farm.

-Continued-

Anhydrous Ammonia

WAC 296-826-100

Scope

WAC 296-826-100

Scope (continued)

References:

- For requirements on agricultural operations using anhydrous ammonia, go to Part U-1 of chapter 296-307 WAC.
- If you use, handle, store, distribute, or transport anhydrous ammonia in quantities of 10,000 pounds or more, follow the requirements found in another chapter, Process safety management of highly hazardous chemicals, chapter 296-67 WAC.
- To protect employees handling ammonia, in addition to this chapter, you will need the following requirements found in other chapters:
  - The following sections from the Safety and Health Core Rules, Chapter 296-800 WAC:
    - Accident Prevention Program, WAC 296-800-140
    - Emergency Washing, WAC 296-800-150
    - Personal Protective Equipment, WAC 296-800-160
  - Emergency Response, Chapter 296-824 WAC
  - Respirator Hazards, Chapter 296-841 WAC
  - Respirators, Chapter 296-842 WAC

Employee Safety

WAC 296-826-200

Contents

YOUR RESPONSIBILITY:

To protect employees who use, handle, store, distribute, or transport anhydrous ammonia

Employee Safety

WAC 296-826-200

Rule

WAC 296-826-20005

Personal protective equipment (PPE)

You must

- Provide the following PPE at all stationary storage installations:
  - Two respirators in readily accessible locations as required by WAC 296-842, Respirators
  - One pair of protective gloves, boots, pants, a protective slicker, and a jacket made of:
    - Rubber
    - **or**
    - Other material that can't be penetrated by ammonia.
  - Tight fitting vented goggles and one full face shield.
  - An easily accessible shower or 50 gallons of clean water in an open top container.
- Equip tank motor vehicles with all of the following equipment for emergency purposes:
  - At least 5 gallons of water to flush liquid ammonia from skin or eyes.
  - Respiratory equipment suitable for anhydrous ammonia as required by chapter 296-842 WAC, Respirators
  - A pair of protective gloves made of neoprene rubber or other material that can't be penetrated by ammonia.
  - Tight fitting goggles and a full face shield

Note:

Additional safety equipment is recommended when more than one employee is present.

WAC 296-826-20010

Training

You must

- Train employees who handle ammonia on all of the following:
  - Safe operating practices
  - Emergency procedures
  - Proper use of personal protective equipment (PPE)

WAC 296-826-20015

Chemical reactions

You must

- Prohibit the use of ammonia with other chemicals unless the possible reactions have been adequately investigated.

Note:

- Under some circumstances, ammonia and ammonium compounds can form explosive products with other chemicals. For additional information, refer to the following:
  - Section 491M "Manual on Hazardous Chemical Reactions" of the NFPA, 1969 Edition

    and
  - CG-388, the "Chemical Data Guide for Bulk Shipment by Water," 1969

Employee Safety

WAC 296-826-200

Rule

WAC 296-826-20020

Emergencies

You must

- Make sure only trained personnel designated to respond if a leak occurs in an ammonia system do all of the following:
  - Evacuate affected personnel to noncontaminated areas
  - Shut off appropriate valves
  - Put on all of the following PPE in concentrated ammonia atmospheres and in unknown concentrations of ammonia:
    - Self-contained breathing apparatus (SCBA)
    - A plastic or rubber suit
    - Gauntlet-type plastic or rubber gloves
- Make sure a physician treats all employees with eye injuries caused by liquid ammonia. In addition:
  - Immediately flush liquid ammonia from skin or eyes continuously for a minimum of 15 minutes using water or eye wash solutions as required by the Safety and Health Core Rules First Aid, WAC 296-800-150.
  - Don't use neutralizing solutions or ointments on affected areas.

Note:

➢ Drivers unable to stop a leak during transport should:

- Move the vehicle to an isolated area
- Use the current Department of Transportation (DOT) Emergency Response Guidebook to establish safe distances to isolate a leaking tank from the driver and the public.

Design, Construction and Installation

WAC 296-826-300

Section Contents

YOUR RESPONSIBILITY:

To make sure containers and tanks used for storing, distributing, or transporting anhydrous ammonia meet design, construction and installation requirements

CONTAINER LOCATION AND MARKING

-Continued-

Design, Construction and Installation

WAC 296-826-300

Section Contents

Design, Construction and Installation

WAC 296-826-300

Rule

CONTAINER LOCATION AND MARKING

WAC 296-826-30005

General specifications

You must

- Locate containers either:
  - In buildings or parts of the building provided for ammonia storage

    or
  - Outside, away from densely populated areas.
- Locate containers according to Table 1, Minimum Distances for Container Location.

Table 1
Minimum Distances for Container Location

Minimum Distances (feet) from Container to:			
Nominal Capacity of Container	**Line of Adjoining Property Which may be Built upon, Highways & Mainline of Railroad**	**Place of Public Assembly**	**Institution Occupancy**
Over 500 to 2,000	25	150	250
Over 2,000 to 30,000	50	300	500
Over 30,000 to 100,000	50	450	750
Over 100,000	50	600	1,000

You must

- Make sure containers are located to meet all of the following:
  - Away from readily ignitable materials such as weeds, long dry grass, and waste.
  - So there's no adverse impact on employee health through unnecessary exposure.
  - At least 50 feet away from dug wells and other sources of potable water.
  - If the container is a part of a water treatment installation, then this requirement doesn't apply.
- Maintain legibility of all container and valve markings.

Design, Construction and Installation

WAC 296-826-300

Rule

WAC 296-826-30010

Specifications for portable DOT containers

IMPORTANT:

This section applies to systems that use cylinders, portable tanks (DOT-51), or "ton containers" (DOT-106A, DOT-110A), constructed according to DOT specifications.

You must

- Locate containers aboveground, never buried below the ground.
- Put containers on firm ground or secure them.
- Guard against settling on the outlet piping by using a flexible connection or a special fitting.
- Protect containers from all of the following:
  - Ignitable debris
  - External damage including corrosion
  - Heat sources, like radiant flames and steam pipes
  - Moving vehicles.
- Prohibit the use of heat to raise the container pressure.

Design, Construction and Installation

WAC 296-826-300

Rule

WAC 296-826-30015

Nonrefrigerated stationary containers

You must

- Construct and test containers according to the Unfired Pressure Vessel Code.
- Make sure the minimum design pressure of the container is 250 psig
- Make sure all containers with a capacity exceeding 250 gallons are constructed to meet one or more of the following:
  - Stress relieved after fabrication according to the Unfired Pressure Vessel Code
  - Have stress relieved cold-formed heads
  - Hot-formed heads

WAC 296-826-30020

Refrigerated storage

You must

- Make sure the minimum design temperature is the same as the refrigerated temperature of the tank.
- Construct and test containers, with a design pressure exceeding 15 psig, according to the Unfired Pressure Vessel Code.
- Select construction materials from those listed from API Standard 620, 4th Edition 2002, Recommended Rules for Design and Construction of Large, Welded Low Pressure Storage Tanks.
- Construct tanks with a design pressure with 15 psig or less according to API Standard 620, 4th Edition, 2002.
- Use ASME Code as a guide in the selection of austenitic steels or nonferrous materials, if used at the design temperature.

Design, Construction and Installation

WAC 296-826-300

Rule

WAC 296-826-30025

Systems mounted on trucks, semi-trailers, and trailers

You must

- Construct and test containers, when transported within the state of Washington, according to both of the following:
  - A minimum design pressure of 250 psig
  - The Unfired Pressure Vessel Code.
- Construct containers used for interstate transport according to DOT regulations.
- Make sure the shell or head thickness of any container is at least 3/16 of an inch.
- Make sure electrical lighting circuits meet all of the following:
  - Have suitable over-current protection, such as fuses or automatic circuit breakers.
  - Are suitably secured, insulated, and protected against physical damage.
  - Have wiring with sufficient carrying capacity and mechanical strength.
- Use only electric light.

WAC 296-826-30030

Systems mounted on farm trucks or trailers for transporting ammonia

You must

- Construct and test containers, with a design pressure exceeding 15 psig, according to the Unfired Pressure Vessel Code.

WAC 296-826-30035

Systems mounted on farm equipment for ammonia application

You must

- Construct and test containers according to the Unfired Pressure Vessel Code.

WAC 296-826-30040

DOT containers

You must

- Make sure containers meet DOT specifications.

Design, Construction and Installation

WAC 296-826-300

Rule

NONREFRIGERATED CONTAINERS

WAC 296-826-30045

Installation

You must

- Provide a minimum distance of 5 feet between aboveground and underground containers that have more than a 1,200 gallon capacity each.
- Protect containers from floating away, in areas with a potential for high flood waters, by providing either:
  - Secure anchorage

    or
  - Adequate pier height.
- Follow Table 2 for aboveground, nonrefrigerated containers.

-Continued-

WAC 296-826-30045
Installation (continued)

Table 2
Aboveground Nonrefrigerated Container Requirements

If you have	Then
Above ground containers	• Provide one of the following: – Substantial reinforced concrete footings and foundations **or** – Structural steel supports mounted on reinforced concrete foundations. • Make sure the reinforced concrete foundation meets all of the following: – Extends below the established frost line – Is of sufficient width and thickness to support the total weight of the containers and contents – Has the lowest point of the tank at least 18 inches above the ground. • Make sure the footings meet all of the following: – Extend below the established frost line – Are of sufficient width and thickness to support the total weight of the containers and contents.
Floating type foundations on containers installed aboveground	Make sure they are designed to adequately support the tank, contents, and pumping equipment.
A horizontal, above ground container	• Mount the container on a foundation that permits expansion and contraction. • Prevent the weight of excessive loads from resting on the supporting portion of the shell. • Provide saddle bearing that extends over at least 1/3 the circumference of the shell. • Prevent corrosion on the portions of the container in contact with the foundations or saddles.

-Continued-

Design, Construction and Installation

WAC 296-826-300

Rule

WAC 296-826-30045

Installation (continued)

You must

- Follow Table 3 for underground, non-refrigerated containers.

Table 3
Underground Nonrefrigerated Container Requirements

If you have	Then
Underground containers	• Set the containers on firm foundations or earth – Surround containers with soft earth or sand well tamped into place. • Make sure the top of the container is at least one foot below the surface of the ground. – If ground conditions make this impractical, use precautions to prevent physical damage to the container. **Exemption:** It isn't necessary to cover the portion of the container where a manhole and other connections are attached. • Securely anchor or weight containers when necessary to prevent floating. • Have a protective corrosion resistant coating applied before it's placed underground that's both of the following: – Satisfactory to the authority having jurisdiction **and** – Equal to either hot dip galvanizing or 2 preliminary coatings of red lead followed by a heavy coating of coal tar or asphalt. • Lower containers onto firm foundations without damaging the protective corrosion resistant coating.

WAC 296-826-30050

Reinstallation

You must

- Prohibit the reinstallation of nonrefrigerated, previously installed underground, containers unless they meet both of the following:
  - Pass a hydrostatic pressure retest using the original pressure specified by the Unfired Pressure Vessel Code under which the tank was constructed

    and
  - Show no evidence of serious corrosion.
- Maintain a corrosion resistant coating on reinstalled underground containers.

REFRIGERATED STORAGE TANKS

WAC 296-826-30055

Installation

You must

- Support tanks on noncombustible foundations designed for the type of tank.
- Provide protection against flotation or other water damage, where high floodwater might occur.
- Prevent the effects of freezing and consequent frost heaving, in tanks used for product storage at less than 32°F, by providing either support or heat supply.

-Continued-

Design, Construction and Installation

WAC 296-826-300

Rule

WAC 296-826-30055

Installation (continued)

You must

- Prevent accidental discharge of liquids from spreading into uncontrolled areas by providing, to the area surrounding a refrigerated tank or group of tanks, one of the following:
  - A drainage system provided with at least a one percent slope that terminates in an impounding basin with a capacity as large as the largest tank served

    or
  - A diked enclosure with a capacity as large as the largest tank served.
- Meet, when using a diked enclosure or an impounding basin in a drainage system, the following requirements:
  - The wall is made of earth, steel, or concrete. If made of earth, meet both of the following:
    - The top is flat and at least 2 feet wide

      and
    - There's a stable slope consistent with the angle of the earth used
  - Design the wall to be both:
    - Liquid tight

      and
    - Able to withstand the hydrostatic pressure and the temperature.
- Provide for drainage of rain water, that doesn't permit the release of ammonia, from diked or impounding areas.

Note:

- It's recommended that the ground in an impounding basin or within a diked enclosure be graded so that small spills or the early part of a large spill will accumulate at one side or corner contacting both:
  - A relatively small area of ground

    and
  - Exposing a relatively small surface area for heat gain.
- Shallow channels in the ground surface or low curbs of earth can help guide the liquid to these low areas without contacting a large ground area.

WAC 296-826-30060

Reinstallation

You must

- Make sure moved and reinstalled containers of a size to require field fabrication are reconstructed and reinspected to:
  - Meet the original Unfired Pressure Vessel Code under which the tank was manufactured and do the following according to the same code:
    - A pressure retest
    - Any necessary rerating.

Notes

Equipment and Systems

WAC 296-826-400

Section Contents

YOUR RESPONSIBILITY:

To make sure all equipment and systems are operated and maintained safely

PIPING, TUBING, AND FITTINGS

REFRIGERATION STORAGE

Equipment and Systems

WAC 296-826-400

Rule

WAC 296-826-40005

Electrical

You must

- Use electrical equipment and wiring on ammonia installations that's either of the following:
  - General purpose

    or
  - Weather resistant.
- Follow the electrical requirements found in another chapter, chapter 296-24 WAC, Part L for Class 1, Group D locations when the concentrations of ammonia in air are in excess of 16 percent by volume.

WAC 296-826-40010

Hose specifications

You must

- Make sure hose used in ammonia service and subject to container pressure meets both of the following:
  - The Joint Rubber Manufacturers Association, RMA-IP-14, Specifications for Anhydrous Ammonia Hose 7th Edition 2003

    and
  - The Fertilizer Institute “Hose Specifications for Anhydrous Ammonia.”
- Make sure hose assemblies are able to withstand a 500 psig pressure test.
- Follow Table 4 for hose specifications.

-Continued-

WAC 296-826-40010
Hose specifications (continued)

Table 4
Hose Specifications

If you have	Then
Hose subject to container pressure	• Design it with a minimum: – Working pressure of 350 psig **and** – Burst pressure of 1750 psig
Hose and their connections	• Design them for the maximum low side working pressure when located on either: – The pressure reducing valves on devices discharging to atmospheric pressure **or** – The low pressure side of flow control. • Design, construct, and install so there's no leakage when connected.
Liquid transfer hose that isn'tdrained of liquid upon completion of transfer operations	• Equip with an approved shut off valve at the discharge end. • Prevent excessive hydrostatic pressure in the hose.
Hose with an outside diameter one-half inch and larger	Make sure the hose is marked and legible at 5 foot intervals.

Equipment and Systems

WAC 296-826-400

Rule

PIPING, TUBING, AND FITTINGS

WAC 296-826-40015

General requirements for all systems

You must

- Prohibit the use of cast iron fittings.
  - The use of malleable or nodular iron such as Specification ASTM A47 or ASTM A395 is permitted.
- Make sure all metal flexible connections for permanent installations have a minimum working pressure of 250 psig
- Make sure all pipes, tubes, and fittings used for ammonia service meet all of the following:
  - Made of material with a design pressure at least equal to the maximum service pressure.
  - Well supported and have provisions for all of the following:
    - Expansion
    - Contraction
    - Vibration
    - Jarring
    - Settling.
- Protect all exposed pipes from damage resulting from undue strain including:
  - Moving machinery
  - The presence of vehicles.
- Use ammonia resistant joint compounds.
- Make sure, after assembly, that all piping and tubing are leak free at a pressure not less than the normal operating pressure of the system.

WAC 296-826-40020

Nonrefrigerated systems

You must

- Make sure piping on nonrefrigerated systems is:
  - ASTM A-53-2004 Electrical Resistance Welded and Electric Flash Welded Pipe or equal. In addition piping needs to be:
    - At least schedule 80 when joints are threaded.
    - At least schedule 40 when joints are either welded or welded and flanged.
- Prohibit the use of piping or tubing made of any of the following:
  - Brass
  - Copper
  - Galvanized steel.

WAC 296-826-40025

Systems mounted on trucks, semi-trailers, and trailers

You must

- Make sure all piping, tubing, and fittings are:
  - Securely mounted
  - Protected against physical damage.

Equipment and Systems

WAC 296-826-400

Rule

REFRIGERATED STORAGE

WAC 296-826-40030

Refrigerated storage compressors

You must

- Make sure compressors have all of the following:
  - Their own driving unit
  - Discharge pressure that's governed by the condensing conditions
  - Suitable compressor operation controls based on the load pressure in the container
  - At least 2 compressors, either of which is of sufficient size to handle the intended loads
  - Standby equipment equal to the largest normally operating piece of equipment installed when more than 2 compressors are provided
  - Automatic controls installed to prohibit the operation of alternate compressors unless the controls will function with alternate compressors.
- Make sure compressors are sized to operate with a suction pressure that's both of the following:
  - At least 10 percent below the minimum setting of the safety relief valves on the storage tank
  - Able to withstand 120 percent of the design pressure of the tank.
- Install an oil separator of suitable size in the compressor discharge line that's both:
  - Designed for at least 250 psig

    and
  - Equipped with a drain valve and gauging device.

WAC 296-826-40035

Refrigeration load

You must

- Make sure the total refrigeration load includes the loads imposed by all of the following:
  - Heat flow into the container caused by the temperature difference between both:
    - The ambient temperature

      and
    - The design storage temperature
  - Heat flow into the tank caused by maximum sun radiation
  - Filling the tank with ammonia warmer than the design storage temperature.
- Provide emergency power capable of handling loads imposed by both of the following:
  - The temperature difference between the ambient temperature and the design storage temperature

    ˜ **and**
  - Sun radiation.

Note:

Emergency power isn't necessary for facilities able to effectively vent vapors when the refrigeration system isn't operating.

Equipment and Systems

WAC 296-826-400

Rule

WAC 296-826-40040

Separators for refrigerated storage

You must

- Install an entrainment separator, of suitable size and design pressure, in the compressor suction line that's equipped with both of the following:
  - A drain valve

    and
  - A gauging device.

WAC 296-826-40045

Automatic control equipment for refrigerated storage

You must

- Install an emergency alarm to detect minimum and maximum allowable operating pressure changes.
- Install an emergency alarm and shut off in the condenser system to detect excess discharge pressure caused by the failure of the cooling medium.

WAC 296-826-40050

Other refrigerated storage equipment

You must

- Discharge ammonia to storage by using either:
  - A receiver with an automatic float valve

    or
  - A high pressure liquid drain trap of suitable capacity.
- Make sure receivers are:
  - Designed for at least 250 psig

    and
  - Equipped with all of the following:
    - Necessary connections
    - Safety relief valves
    - Gauging devices.
- Cover insulated containers and pipelines with material that meets all of the following:
  - Thick enough for the temperatures it will be exposed to
  - Supported
  - Weather and fire resistant.

Equipment and Systems

WAC 296-826-400

Rule

WAC 296-826-40055

Compressors for refrigerated systems

You must

- Make sure condensers are designed:
  - For at least 250 psig

    and
  - To manually or automatically purge noncondensibles.

Note:

- Condensers may be cooled by any of the following:
  - Air
  - Water
  - Air and water.

You must

- Make sure compressors used for refrigerating ammonia meet all of the following:
  - Are connected to plant piping with shut off valves located as close as practical to compressor connections
  - Have a safety relief valve that's both:
    - Large enough to discharge the full capacity of the compressor

      and
    - Connected to the discharge and placed before any shut off valve
  - Have an oil separator on the discharge side, where necessary to prevent contamination.
  - Have a drainable liquid trap or other adequate method on the compressor suction to minimize the entry of liquids into the compressor.
  - Pressure gauges on the suction and discharge ends graduated to at least one and one-half times the maximum pressure that can develop.

Appurtenances

WAC 296-826-500

Section Contents

YOUR RESPONSIBILITY:

To follow the requirements in this section when using appurtenances

Appurtenances

WAC 296-826-500

Rule

WAC 296-826-50005

Appurtenance requirements for all systems

Definition:

Appurtenance means all devices such as pumps, compressor, safety relief devices, liquid-level gauging devices, valves and pressure gauges.

You must

- Make sure each appurtenance installed before February 8, 1973, is determined to be safe by meeting one of the following:
  - Approved, tested, and installed by either:
    - The American National Standard for the Storage and Handling of Anhydrous Ammonia (in effect at the time of installation)
    - The Fertilizer Institute Standards for the Storage and Handling of Agricultural Anhydrous Ammonia (in effect at the time of installation)
  - Accepted, certified, listed, or labeled, by a nationally recognized testing laboratory
  - Inspected or tested by a federal, state, municipal, or local authority responsible for enforcing occupational safety provisions, when no nationally recognized laboratory will provide approval
  - Tested and approved by a registered professional engineer or other qualified person if the system is a custom-designed or custom-built unit and no other recognized entity will provide approval
  - Keep a document on file signed by the qualified person that indicates the unit's safe. Include the test bases, test data and results and the qualifications of the qualified person.

-Continued-

WAC 296-826-50005
Appurtenance requirements for all systems (continued)

You must

- Make sure container appurtenances are both of the following:
  - Designed for at least the working pressure for the portion of the system where installed

    and
  - Fabricated from materials suitable for anhydrous ammonia service.
- Make sure fixed liquid level gauges, except on refrigerated storage:
  - Are designed so the maximum volume of the container filled by liquid doesn't exceed 85 percent of its water capacity

    and
  - Have a coupling into which it's threaded that's placed at the 85 percent level of the container
    - If located elsewhere, install the dip tube of this gauge so it can't be easily removed.
- Equip each container, except those filled by weight, with an approved liquid level gauging device that does all of the following:
  - Has a design pressure equal to or greater than the design pressure of the container
  - Are arranged so the maximum liquid fill level of containers can be readily determined.
- Follow additional requirements found in Table 5, Appurtenance Requirements for all Systems

-Continued-

Appurtenances

WAC 296-826-500

Rule

WAC 296-826-50005

Appurtenance requirements for all systems (continued)

Table 5
Appurtenance Requirements for all Systems

If you have	Then make sure they
Safety relief devices	Don't have discharge termination in or beneath any building.
Safety relief valves	Have a flow capacity that isn't restricted by any connection to it on either the upstream or downstream side.
Connections to containers	Have shut off valves located as close to the container as possible. **Exemption:** Safety relief devices, gauging devices or devices fitted with a No. 54 drill size hole aren't required to have shut off valves located as close to the container as possible
Connections and the line, including valves and fittings	Have a greater rated flow than the excess flow valves that protects them
Excess flow valves, where required	Meet all of the following: • Are designed with a bypass no larger than a No. 60 drill size opening to allow equalization of pressures. • Close automatically at the rated flow of vapor or liquid specified by the manufacturer. • Maintain legible markings.
Excess flow valves provided with shut off valves Excess flow and back pressure check valves, where required	Are designed to close if the shut off valve breaks during installation Are located either: • Inside the container **or** • Outside the container as long as the excess flow valve is: – As close as possible to the entrance of the line **and** – Installed without excessive stress that could result in breakage between the container and the valve.
Liquid level gauging devices that: Require bleeding of the product into the atmosphere such as the rotary tube, fixed tube, and slip tube devices	Are either: • Designed so that the maximum opening of the bleed valve isn't larger than No. 54 drill size **or** • Provided with an excess flow valve. **Exemption:** ➢ If openings from the containers or through fittings are attached directly onto the container where pressure gauge connections are made, then there's no need for excess flow valves as long as the openings aren't larger than a No. 54 drill size ➢ This requirement doesn't apply to farm vehicles used for the application of ammonia as covered by WAC 296-826-50030.

-Continued-

WAC 296-826-50005
Appurtenance requirements for all systems (continued)

You must

- Follow Table 6, Safety Valve Start to Discharge Rate, and Table 7, Safety Relief Valve Rate of Discharge, for the following systems:
  - Nonrefrigerated stationary containers
  - Mounted on trucks, semi-trailers, and trailers used for the transportation of ammonia
  - Mounted on farm wagons for the transportation of ammonia
  - Mounted on farm equipment for the application of ammonia

Exemption:

The rate of discharge of spring-loaded safety relief valves installed on underground containers may be reduced to 30 percent of the rate of discharge specified in Table 6, Safety Relief Valve Rate of Discharge so long as the container isn't uncovered after installation until the liquid ammonia has been removed.

Table 6
Safety Valve Start to Discharge Rate

Containers	Minimum	Maximum*
ASME U-68, U-69	110%	125%
ASME U-200, U-201	95%	100%
ASME 1952, 1956, 1959, 1962, 1965, 1968, or 1971	95%	100%
API-ASME	95%	100%
U.S. Coast Guard	(As required by U.S.C.G. regulations)	
DOT	(As required by DOT regulations)	

Note:

A relief valve manufacturer's tolerance of plus 10 percent is permitted.

-Continued-

Rule

WAC 296-826-50005

Appurtenance requirements for all systems (continued)

Table 7

Safety Relief Valve Rate of Discharge

Instructions are found below the table

Surface Area sq. ft.	Flow Rate CFM Air	Surface Area sq. ft.	Flow Rate CFM Air	Surface Area sq. ft.	Flow Rate CFM Air	Surface Area sq. ft.	Flow Rate CFM Air
20	258	145	1,310	340	2,640	1,350	8,160
25	310	150	1,350	350	2,700	1,400	8,410
30	360	155	1,390	360	2,760	1,450	8,650
35	408	160	1,420	370	2,830	1,500	8,900
40	455	165	1,460	380	2,890	1,550	9,140
45	501	170	1,500	390	2,950	1,600	9,380
50	547	175	1,530	400	3,010	1,650	9,620
55	310	180	1,570	450	3,320	1,700	9,860
60	360	185	1,600	500	3,620	1,750	10,090
65	408	190	1,640	550	3,910	1,800	10,330
70	455	195	1,670	600	4,200	1,850	10,560
75	762	200	1,710	650	4,480	1,900	10,800
80	804	210	1,780	700	4,760	1,950	11,030
85	845	220	1,850	750	5,040	2,000	11,260
90	885	230	1,920	800	5,300	2,050	11,490
95	925	240	1,980	850	5,590	2,100	11,720
100	965	250	2,050	900	5,850	2,150	11,950
105	1,010	260	2,120	950	6,120	2,200	12,180
110	1,050	270	2,180	1,000	6,380	2,250	12,400
115	1,090	280	2,250	1,050	6,640	2,300	12,630
120	1,120	290	2,320	1,100	6,900	2,350	12,850
125	1,160	300	2,380	1,150	7,160	2,400	13,080
130	1,200	310	2,450	1,200	7,410	2,450	13,300
135	1,240	320	2,510	1,250	7,660	2,500	13,520
140	1,280	330	2,570	1,300	7,910		

-Continued-

WAC 296-826-50005
Appurtenance requirements for all systems (continued)

- Table instructions:
  - The surface area = the total outside surface area of the container in square feet.
  - When the surface area isn't stamped on the name plate or the marking isn't legible, calculate the area by using the Table 8, Surface Area

Table 8
Surface Area

If you have	Then calculate as follows
Cylindrical container with hemispherical heads	Area = overall length in feet times the outside diameter in feet times 3.1416
Cylindrical container with other than hemispherical heads	Area = (overall length in feet plus 0.3 outside diameter in feet) times outside diameter in feet times 3.1416
Spherical container	Area = outside diameter in feet squared times 3.1416

- Flow rate -- CFM air = cubic feet per minute of air required at standard conditions, 60°F and atmospheric pressure (14.7 psia).
  - The rate of discharge may be altered for intermediate values of surface area.
  - For containers with total outside surface area greater than 2,500 sq. ft., the required flow rate can be calculated using the formula, flow rate CFM air = 22.11 A0.82 where A =outside surface area of the container in square feet.

Appurtenances

WAC 296-826-500

Rule

WAC 296-826-50010

Nonrefrigerated stationary containers

IMPORTANT:

In addition to this section, you need to follow the Appurtenances requirements for all systems, WAC 296-826-50005.

You must

- Make sure all containers are equipped with all of the following:
  - An approved vapor return valve
  - A fixed maximum liquid level gauge
  - A pressure gauge that's both:
    - Graduated from zero to 400 psig

      and
    - Designed for use in ammonia service
- Provide one or more spring-loaded safety relief valves, or an equivalent type, on all containers.
- Make sure safety relief valves do all of the following:
  - Discharge in the following ways:
    - Away from the container in an upward, unobstructed manner into the atmosphere
    - Not in or beneath a building
  - Have raincaps that allow free discharge of the vapor and prevent the entrance of water
  - Have a method for draining accumulated condensation
  - Have a start to discharge, related to the design pressure of the container, according to Table 6, Safety Valve Start to Discharge Rate

-Continued-

WAC 296-826-50010
Nonrefrigerated stationary containers (continued)

- Are arranged to minimize the possibility of tampering
- Are provided, when the pressure setting adjustment is external, with a means of sealing the adjustment
- Have direct communication with the vapor space of the container

Note:

- Vent pipes from 2 or more safety relief devices located on the same unit, or similar lines from 2 or more different units, may be run into a common header if:
  - The cross-sectional area of the header is at least equal to the sum of the cross sectional areas of the individual vent pipes.

You must

- Protect container appurtenances against physical damage and during transit of containers intended for underground installation.
- Make sure shut off valves aren't installed between the safety relief valve and the container or system. A shut off valve may be used if arranged so that the required capacity flow is maintained.

-Continued-

Appurtenances

WAC 296-826-500

Rule

WAC 296-826-50010

Nonrefrigerated stationary containers (continued)

Exemption:

- You're exempt from the requirement not to install the shut off valve between the safety relief valve and the container or systems in the following situations:
  - A 3-way valve installed under 2 safety relief valves, each with:
    - The required rate of discharge
    - **and**
    - Installed to allow either of the safety relief valves to be closed off but not at the same time.
  - Two separate relief valves are installed with individual shut off valves.
  - The 2 shut off valve stems must be mechanically interconnected to allow the full required flow of one safety relief valve at all times.
  - When a safety relief valve manifold that allows:
    - One valve of 2 or more to be closed off
    - **and**
    - The remaining valve or valves will provide not less than the rate of discharge shown on the manifold nameplate.

You must

- Make sure vapor and liquid connections have either of the following:
  - An approved excess flow valve

    or
  - An approved quick-closing internal valve that remains closed except during operation.

Exemption:

- The following don't need to be fitted with excess flow valves:
  - Safety relief valves
  - Liquid level gauging devices that require both of the following:
    - Bleeding of the product into the atmosphere
    - Construction so that outward flow won't exceed that passed by a No. 54 drill size opening
  - Those with openings from the containers or through fittings that are attached directly onto the container where pressure gauge connections are made as long as:
    - The openings aren't larger than a No. 54 drill size.

-Continued-

WAC 296-826-50010
Nonrefrigerated stationary containers (continued)

You must

- Follow additional requirements found in Table 9, Appurtenances for Nonrefrigerated Stationary Containers.

Table 9
Appurtenances for Nonrefrigerated Stationary Containers

If you have	Then make sure they
Columnar-type gauges	• Are restricted to stationary storage installations • Are shielded against the direct rays of the sun • Are equipped with all of the following: – Shut off valves having metallic hand-wheels – Excess flow valves – Extra heavy glass that's adequately protected with a metal housing applied by the gauge manufacturer
Main shut off valves	• Are kept closed and locked when the installation is unattended **Exemption:** Valve locks aren't required if the facility is protected against tampering by fencing or other suitable means.
Filling connections	• Are provided with one of the following: – Combination back-pressure check valve and excess flow valve – One double or 2 single back-pressure check valves – A positive shut off valve in conjunction with either an internal back-pressure check valve or an internal excess flow valve
Underground installations with a probability of the manhole or housing becoming flooded	• Have vent lines located above the high water level • Have manholes or housings with ventilated louvers or their equivalent with the area of their openings equal or exceeding: – The combined discharge areas of the safety relief valves and vent lines which discharge their content into the manhole housing
Hydrostatic relief valves	Are installed between each pair of valves in the liquid ammonia piping or hose.

Appurtenances

WAC 296-826-500

Rule

WAC 296-826-50015

Refrigerated tanks

IMPORTANT:

In addition to this section, you need to follow the Appurtenances requirements for all systems, WAC 296-826-50005.

You must

- Protect container appurtenances against the following:
  - Physical damage during transit of containers intended for underground installation
  - Damage from vehicles.
- Make sure safety relief devices have a total relieving capacity larger than either of the following:
  - A possible refrigeration system upset such as a cooling water failure, power failure, instrument air or instrument failure, mechanical failure of any equipment, excessive pumping rates or changing atmospheric pressure

  ~ **or**

  - The amount based on using either one of the following fire exposure formulas (see note below for codes):
    - Valve manufacturers who use weight of vapors to be relieved as the classifying basis, use this formula:

$$W = \frac{34{,}500\ F\ A\ (0.82)}{L}$$

or

Valve manufacturers that classify valves based on air flows, use this formula:

$$Q_{(a)} = \frac{633{,}000\ F\ A\ (O.32)}{LC}$$

-Continued-

WAC 296-826-50015
Refrigerated tanks (continued)

You must

- Make sure safety relief devices meet the following additional requirements:
  - Are set to start-to-discharge at a pressure not in excess of the design pressure of the tank
  - Have a total relieving capacity sufficient to prevent a maximum pressure in a tank of more than 120 percent of the design pressure.
- Provide shut off valves for all connections including plugs, safety valves, and thermometer wells:
  - Locate them as close to the tank as is practical.

Exemption:

Shut off valves don't need to be provided on connections with a No. 54 drill size restriction

Note:

- Install, when operating conditions make it advisable, both of the following:
  - A check valve on the fill connection
  - A remotely operated shut off valve on other connections located below the maximum liquid level.

-Continued-

Appurtenances

WAC 296-826-500

Rule

WAC 296-826-50015

Refrigerated tanks (continued)

You must

- Follow requirements found in Table 10, Refrigerated Tank Appurtenances

Table 10
Refrigerated Tank Appurtenances

If you have	Then make sure they
Shut off valves used as a means of lock out for inspection or repair	• Are of adequate flow capacity • Are arranged to be locked or sealed open and not closed except by an authorized person who does both of the following: – Remains there while the valve is closed – Locks or seals the valve open when leaving the station.
Discharge line and header	• Are designed to accommodate the maximum flow. • Have a back pressure not greater than 10 percent of the design pressure of the storage container • Include the back pressure in the 120 percent of the maximum pressure of the design pressure. • Don't have other containers or systems that exhaust into the discharge line or header. • Have vent lines installed to prevent the accumulation of liquid in the lines **Note:** Multiple safety relief valves on the same storage unit may be run through a common discharge header.
Vacuum breakers	Are provided with atmospheric storage
Stacks	• Do both of the following: – Prevent any obstructions by rain, snow, ice, or condensation **and** – Have an outlet size not smaller than the size of the safety relief valve outlet connection

-Continued-

WAC 296-826-50015
Refrigerated tanks (continued)

You must

- Make sure appurtenances meet all of the requirements found in the following:
  - ANSI CGA C-7 2004
  - ANSI CGA G2.1 1999
  - API Standard 620 4th Edition, 2002
  - ASHRAE 15 2004
  - ASME 2001, Section VIII, Division 1
  - ANSI B95.1 1977

WAC 296-826-50020
Systems mounted on trucks, semi-trailers and trailers

IMPORTANT:

In addition to this section, you need to follow the Appurtenances requirements for all systems, WAC 296-826-50005.

You must

- Make sure each container has all of the following:
  - Fixed maximum liquid level gauging devices
  - Pressure-indicator gauges with a dial graduated from zero to 400 psig
  - Either of the following:
    - Equipped for spray-loading, which fills in vapor space

      or
    - Has an approved vapor return valve of adequate capacity.

-Continued-

Appurtenances

WAC 296-826-500

Rule

WAC 296-826-50020

Systems mounted on trucks, semi-trailers and trailers (continued)

You must

- Provide one or more spring-loaded safety relief valves, or an equivalent type, on all containers, that do all of the following:
  - Discharges in the following ways:
    - Away from the container in an upward, unobstructed manner into the atmosphere
    - Not in or beneath a building.
  - Has raincaps that allow free discharge of the vapor and prevent the entrance of water
  - Has a method for draining accumulated condensation
  - Has a start to discharge, related to the design pressure of the container, according to Table 6, Safety Valve Start to Discharge Rate
  - Are arranged to minimize the possibility of tampering
  - Provided, when the pressure setting adjustment is external, with a means of sealing the adjustment
  - Has direct communication with the vapor space of the container
- Make sure shut off valves aren't installed between the safety relief valve and the container or system. A shut off valve may be used if arranged so that the required capacity flow is maintained.

-Continued-

WAC 296-826-50020
Systems mounted on trucks, semi-trailers and trailers (continued)

Exemption:

- You're exempt from the requirement not to install the shut off valve between the safety relief valve and the container or systems in the following situations:
  - A 3-way valve installed under 2 safety relief valves, each with:
    - The required rate of discharge

      and
    - Installed to allow either of the safety relief valves to be closed off but not at the same time.
  - Two separate relief valves are installed with individual shut off valves.
  - The 2 shut off valve stems must be mechanically interconnected to allow the full required flow of one safety relief valve at all times.
  - When a safety relief valve manifold that allows:
    - One valve of 2 or more to be closed off

      and
    - The remaining valve or valves will provide not less than the rate of discharge shown on the manifold nameplate.

You must

- Follow additional requirements found in Table 11, Appurtenances for Systems Mounted on Trucks, Semi-Trailers and Trailers

-Continued-

WAC 296-826-50020
Systems mounted on trucks semi-trailers and trailers (continued)

Table 11
Appurtenances for Systems Mounted on Trucks, Semi-Trailers and Trailers

If you have:	Then make sure they:
All container connections	• Are provided with either of the following: – Automatic excess flow valves **or** – Quick-closing internal valves that remain closed except during delivery operations **Note:** If the control mechanism is provided with a secondary control remote from the delivery connection, then a fusible section (melting point 208°F to 220°F) is required to permit the internal valve to close automatically in case of fire. **Exemption:** Filling connections, safety relief devices, and liquid level and pressure gauge connections are exempt from automatic excess flow valves and quick-closing internal valves.
Filling connections	• Prevent back-flow in the event the filling connection breaks with at least one of the following: – Automatic back pressure check valves – Excess flow check valves – Quick closing internal valves **Exemption:** An automatic valve isn't required if: – The filling and discharge connect to a common opening in the container shell **and** – The opening is fitted with a quick-closing internal valve
Nonrecessed container fittings and appurtenances	• Are protected against physical damage by one of the following methods: – A protected location – The vehicle frame or bumper – A protective housing that meets the following: • Is fabricated from material that's compatible with the containers design and construction requirements • Designed to withstand static loadings in any direction equal to twice the weight of the container and attachments when filled using a safety factor of not less than 4, based on the ultimate strength of the material used **Note:** Protect nonrecessed container fittings and appurtenances with a weather cover as needed for proper operation of valves and safety relief devices
Columnar-type gauges	• Are restricted to stationary storage installations • Are shielded against the direct rays of the sun • Are equipped with all of the following: – Shut off valves having metallic hand-wheels – Excess flow valves – Extra heavy glass that's adequately protected with a metal housing applied by the gauge manufacturer
Hydrostatic relief valves	Are installed between each pair of valves in the liquid ammonia piping or hose.

WAC 296-826-50025

Systems mounted on farm trucks or trailers for transportation of ammonia

IMPORTANT:

- This section applies to containers of 3,000 gallons capacity or less and pertinent equipment mounted on farm trucks or trailers used for the transportation of ammonia.
- In addition to this section, you need to follow the Appurtenances requirements for all systems, WAC 296-826-50005.

You must

- Make sure all containers are equipped with a fixed maximum liquid level gauge.
- Make sure vapor and liquid connections have either of the following:
  - An approved excess flow valve

    or
  - An approved quick-closing internal valve that remains closed except during operation.

Exemption:

- The following don't need to be fitted with excess flow valves:
  - Safety relief valves
  - Those with openings from the containers or through fittings that are attached directly onto the container where pressure gauge connections are made as long as the openings aren't larger than a No. 54 drill size.

-Continued-

Appurtenances

WAC 296-826-500

Rule

WAC 296-826-50025

Systems mounted on farm trucks or trailers for transportation of ammonia (continued)

You must

- Provide one or more spring-loaded safety relief valves, or an equivalent type, on all containers, that do all of the following:
  - Discharges in the following ways:
    - Away from the container in an upward, unobstructed manner into the atmosphere
  - Has raincaps that allow free discharge of the vapor and prevent the entrance of water
  - Has a method for draining accumulated condensation
  - Has a start to discharge, related to the design pressure of the container, according to Table 6, Safety Valve Start to Discharge Rate
  - Are arranged to minimize the possibility of tampering
  - Provided, when the pressure setting adjustment is external, with a means of sealing the adjustment
  - Has direct communication with the vapor space of the container
- Make sure shut off valves aren't installed between the safety relief valve and the container or system. A shut off valve may be used if arranged so that the required capacity flow is maintained.

-Continued-

WAC 296-826-50025

Systems mounted on farm trucks or trailers for transportation of ammonia (continued)

Exemption:

- You're exempt from the requirement not to install the shut off valve between the safety relief valve and the container or systems in the following situations:
  - A 3-way valve installed under 2 safety relief valves, each with:
    - The required rate of discharge

      and
    - Installed to allow either of the safety relief valves to be closed off but not at the same time.
  - Two separate relief valves are installed with individual shut off valves.
    - The 2 shut off valve stems must be mechanically interconnected to allow the full required flow of one safety relief valve at all times.
  - When a safety relief valve manifold that allows:
    - One valve of 2 or more to be closed off

      and
    - The remaining valve or valves will provide not less than the rate of discharge shown on the manifold nameplate.

You must

- Secure both ends of the hose while in transit
- Make sure all containers with a capacity exceeding 250 gallons are equipped with both of the following:
  - A pressure gauge with a dial graduated from 0-400 psig

    and
  - A method for spray loading or with an approved vapor return valve

-Continued-

Appurtenances

WAC 296-826-500

Rule

WAC 296-826-50025

Systems mounted on farm trucks or trailers for transportation of ammonia (continued)

You must

- Follow additional requirements found in Table 12, Appurtenances for Systems Mounted on Farm Trucks or Trailers.

Table 12
Appurtenances for Systems Mounted on Farm Trucks or Trailers

If you have	Then make sure they
Filling connections	• Are fitted with one of the following: – A combination back-pressure check valve and excess flow valve – One double or 2 single back-pressure check valves – A positive shut off valve used with either an: • Internal back-pressure check valve **or** • Internal excess flow valve
A fully enclosed guard	• Have properly vented safety relief valves.
Fittings	• Are protected from physical damage by a rigid guard designed: – To withstand static loading in any direction equal to twice the weight of the container and lading – With a safety factor of 4 based on the maximum strength of the material used
Liquid withdrawal lines installed in the bottom of the container	Have connections, including the hose, that aren't lower than the lowest horizontal edge of the truck axle
Columnar-type gauges	• Are shielded against the direct rays of the sun • Are equipped with all of the following: – Shut off valves having metallic hand-wheels – Excess flow valves – Extra heavy glass that's adequately protected with a metal housing applied by the gauge manufacturer
Hydrostatic relief valves	Are installed between each pair of valves in the liquid ammonia piping or hose.

WAC 296-826-50030

Systems mounted on farm equipment for ammonia application

IMPORTANT:

- This section applies to systems mounted on farm equipment and used for the filed application of ammonia.
- In addition to this section, you need to follow the Appurtenances requirements for all systems, WAC 296-826-50005.

You must

- Make sure each container has a fixed maximum liquid-level gauge.
- Provide one or more spring-loaded safety relief valves, or an equivalent type, on all containers, that do all of the following:
  - Discharges in the following ways:
    - Away from the container in an upward, unobstructed manner into the atmosphere
    - Not in or beneath a building.
  - Has raincaps that allow free discharge of the vapor and prevent the entrance of water
  - Has a method for draining accumulated condensation
  - Has a start to discharge, related to the design pressure of the container, according to Table 6, Safety Valve Start to Discharge Rate
  - Are arranged to minimize the possibility of tampering
  - Provided, when the pressure setting adjustment is external, with a means of sealing the adjustment
  - Has direct communication with the vapor space of the container

-Continued-

Appurtenances

WAC 296-826-500

Rule

WAC 296-826-50030

Systems mounted on farm equipment for ammonia application (continued)

You must

- Make sure shut off valves aren't installed between the safety relief valve and the container or system. A shut off valve may be used if arranged so that the required capacity flow is maintained.

Exemption:

- You're exempt from the requirement not to install the shut off valve between the safety relief valve and the container or systems in the following situations:
  - A 3-way valve installed under 2 safety relief valves, each with:
    - The required rate of discharge

      and

    - Installed to allow either of the safety relief valves to be closed off but not at the same time.
  - Two separate relief valves are installed with individual shut off valves.
  - The 2 shut off valve stems must be mechanically interconnected to allow the full required flow of one safety relief valve at all times.
  - When a safety relief valve manifold that allows:
    - One valve of 2 or more to be closed off

      and

    - The remaining valve or valves will provide not less than the rate of discharge shown on the manifold nameplate.

- Follow additional requirements found in Table 13, Appurtenances for Systems Mounted on Farm Equipment for Ammonia Application

-Continued-

WAC 296-826-50030

Systems mounted on farm equipment for ammonia application (continued)

Table 13
Appurtenances for Systems Mounted on Farm Equipment for Ammonia Application

If you have	Then make sure they
Filling connections	• Are fitted with one of the following: – A combination back-pressure check valve and excess flow valve – One double or 2 single back-pressure check valves – A positive shut off valve used with either an: • Internal back-pressure check valve **or** • Internal excess flow valve **Exemption:** An excess-flow valve isn't required in either of the following: – Vapor connection providing you meet both of the following: • The controlling orifice isn't in excess of 7/16 of an inch in diameter **and** • The valve is hand-operated (attached hand-wheel or equivalent) shut off valve **or** – In the liquid withdrawal line if the controlling opening between the contents of the container and the outlet of the shut off valve don't exceed 7/16 inch in diameter. **Note:** To assist in filling applicator tanks, you're allowed to bleed vapors into the open air if you meet the above requirements.
Columnar-type gauges	• Are shielded against the direct rays of the sun • Are equipped with all of the following: – Shut off valves having metallic hand-wheels – Excess flow valves – Extra heavy glass that's adequately protected with a metal housing applied by the gauge manufacturer
• An applicator tank that's both of the following: – Trailed **and** – The metering device is remotely mounted (for example on a tractor tool bar)	Use an automatic break-away type, self-closing, coupling **Note:** ➢ Metering devices may be connected directly to the tank withdrawal valve. ➢ A union type connection is acceptable between the tank valve and metering device
Hydrostatic relief valves	Are installed between each pair of valves in the liquid ammonia piping or hose.

Appurtenances

WAC 296-826-500

Rule

WAC 296-826-50035

Portable DOT containers

IMPORTANT:

- This section applies to systems that use cylinders, portable tanks (DOT-51), or ton containers (DOT-106A, DOT-110A).
- In addition to this section, you need to follow the Appurtenances requirements for all systems, WAC 296-826-50005.

You must

- Make sure safety relief devices meet DOT specifications.
- Provide the following protection:
  - To valves and pressure regulating equipment from tampering once installed for use
  - To containers:
    - From heat sources such as radiant flame and steam pipes. Don't apply heat directly to containers to raise the pressure
    - From moving vehicles or external damage while being stored
    - From ignitable debris and to prevent external corrosion while being stored. Storage can be indoors or outdoors.
- Protect container valves while in transit, in storage, and while being moved into final use by doing either of the following:
  - Setting them into the recess of the container
  - **or**
  - By fastening a ventilated cap or collar to the container that can withstand a blow from any direction equivalent to a 30-pound weight being dropped 4 feet
    - Construction should be such that a blow won't be transmitted to the valves or other connections.
- Keep outlet valves tightly closed when containers aren't connected for service on all empty or loaded containers
  - Secure the valve protection cap, if the container is designed for one, when the container isn't in service.

Section Contents

YOUR RESPONSIBILITY:

To protect employees while transporting, transferring, loading and unloading anhydrous ammonia

TRANSFERRING LIQUIDS

FILLING DENSITIES

Operations

WAC 296-826-600

Rule

WAC 296-826-60005

Mounting containers on trucks, semi-trailers and trailers

You must

- Make sure the method for attaching any container to the cradle, frame, or chassis of a vehicle is based on both of the following:
  - Two “g” loading in either direction
  - Using a safety factor of at least 4 based on the maximum strength of the material used.

Note:

Two “g” is either of the following:

- For load support it’s equivalent to 3 times the static weight of the supported articles
- For loading and bending, acceleration, and torsion it’s equivalent to twice the static weight support applied horizontally at the road surface.

You must

- Secure both ends of the hose during transit.
- Follow the requirements in Table 14, Additional Container Mounting Requirements.

-Continued-

WAC 296-826-60005

Mounting containers on trucks, semi-trailers and trailers (continued)

Table 14
Additional Container Mounting Requirements

If you have	Then
"Hold-down" devices	• Anchor the container to the cradle, frame, or chassis so there's no area of unnecessary stress • Lock the container down tightly • Provide stops or anchors to minimize movement between the container and the framing **Note:** Movement could be the result of stopping, starting or changing direction.
Vehicles with cargo tanks designed with stress members instead of a frame	• Support the tank with external cradles suspended at least 120 degrees of the shell circumference • The design calculation needs to include all of the following stressors: – Beam – Shear – Torsion – Bending moment – Acceleration – Any other stresses covered by the code of the cargo tank design.
A liquid withdrawal line installed in the bottom of a container	• Then make sure the connections to the container, including the hose, aren't lower than the lowest horizontal edge of the trailer axle.
A cradle and container that aren't welded together	• Use suitable material between them to eliminate metal-to-metal friction.

Operations

WAC 296-826-600

Rule

WAC 296-826-60010

Mounting containers on farm trucks or trailers for transporting ammonia

You must

- Make sure tanks mounted on farm trucks and trailers meet all of the following:
  - Are securely attached using drawbars and safety chains
  - Follow behind the towing vehicle without swerving
  - Have at least 5 gallons of readily available clean water.
- Do all of the following when mounting containers on farm trucks:
  - Use suitable material between the cradle and the container to eliminate metal-to-metal friction
    - This isn't necessary if the cradle and container are welded together
  - Use stops and hold down devices to prevent displacement.
- Distribute the container's weight, when mounted on 4-wheel farm trucks or trailers, evenly over both axles.

WAC 296-826-60015

Tank car loading or unloading

You must

- Establish a location for tank car loading and unloading operations.
- Assign employees and instruct them in the unloading of tank cars.
- Make sure, when unloading cars, to set the brake and block the wheels.
- Make sure the track of tank siding is level.
- Place caution signs on the track or car to warn approaching persons of loading and unloading operations that are:
  - Kept in place until the car is unloaded and disconnected from discharge connections.
- Make sure these caution signs meet all of the following:
  - Are made of metal or other suitable material
  - Are at least 12 to 15 inches in size
  - Read either “Stop-Tank Car Connected” or “Stop-Men at Work” meeting the following criteria:
    - “Stop” at least 4 inches high
    - All other words at least 2 inches high
    - All with white letters on a blue background.

Operations

WAC 296-826-600

Rule

TRANSFERRING LIQUIDS

WAC 296-826-60020

General specifications

You must

- Get owner authorization to use transfer containers.
- Make sure transfer containers are gauged and filled in either:
  - Open atmospheres

    or
  - Buildings approved for that purpose.
- Make sure pumps used to transfer ammonia meet all of the following:
  - Have a manufacturer's label for ammonia service
  - Are designed for at least 250 psig working pressure
  - Have a constant differential relief valve discharging into the suction port that:
    - Is installed on positive displacement pumps

      and
    - Meets the pump manufacturer's recommendation for the settings and installation
  - Have a pressure gauge graduated zero to 400 psig installed on the discharge side before the relief valve line.
- Make sure plant pipes with shut off valves are located as close as possible to the pump connections.
- Make sure meters used for measuring liquid anhydrous ammonia:
  - Are recommended and labeled for ammonia service by the manufacturer
  - Are designed for a minimum working pressure of 250 psig
  - Incorporate devices that prevent unintended measurement of vapor.

-Continued-

WAC 296-826-60020
General specifications (continued)

You must

- Do the following when transferring ammonia:
  - Maintain ammonia at a temperature suitable for the receiving container
  - Have at least one attendant supervise the transfer from the time connections are made to when disconnection occurs
  - Don't use flammable gases or gases that will react with ammonia, such as air to unload tank cars or transport trucks.
- Make sure compressors used for transferring ammonia meet all of the following:
  - Have a working pressure of at least 250 psig when transferring ammonia.
  - If crank cases of compressors aren't designed to withstand system pressure, then provide protection with a suitable safety relief valve
  - Are connected to plant piping with shut off valves located as close as practical to compressor connections
  - Have a safety relief valve that's both:
    - Large enough to discharge the full capacity of the compressor
      and
    - Connected to the discharge before any shut off valve
  - Have an oil separator on the discharge side, where necessary to prevent contamination
  - Have a drainable liquid trap or other adequate method on the compressor suction to minimize the entry of liquids into the compressor
  - Pressure gauges on the suction and discharge ends graduated to at least one and one-half times the maximum pressure that can develop.
- Protect loading and unloading systems in the event of hose severance by suitable devices where necessary, such as:
  - Backflow check valves

    or
  - Properly sized excess flow valves.

Note:

If such valves aren't practical, remotely operated shut off valves may be installed.

Operations

WAC 296-826-600

Rule

WAC 296-826-60025

Additional requirements for systems mounted on trucks, semi-trailers, and trailers for transporting ammonia

You must

- Make sure the content of vehicle containers is determined by one of the following:
  - Weight
  - Liquid-level gauging devices
  - Meters
  - Other approved methods.
- Use a thermometer well when the content of a container is determined by liquid-level measurement. Make sure of the following:
  - The volume, when converted to weight, doesn't exceed the DOT filling density requirement.
- Protect pumps and compressors against physical damage when mounted on trucks or trailers.
- Unload tank motor vehicles with a water capacity greater than 3,500 gallons at approved locations.

FILLING DENSITIES

WAC 296-826-60030

Nonrefrigerated containers

You must

- Make sure filling densities for nonrefrigerated containers are below or equal to the requirements in Table 15, Filling Densities.

Table 15
Filling Densities

Containers	Aboveground Containers	Underground Containers
Uninsulated	56%	58%
Insulated	57%	----

Note:

For uninsulated, aboveground containers, the 56% corresponds to:

- 82% by volume at -28°F.
- 85% by volume at 5°F
- 87.5% by volume at 30°F
- 90.6% by volume at 60°F.

Operations

WAC 296-826-600

Rule

WAC 296-826-60035

Refrigerated tanks

You must

- Make sure refrigerated tanks aren't liquid full at a liquid temperature so that the vapor pressure is below the "start-to-discharge" pressure setting of the safety relief valve.

WAC 296-826-60040

Welding

You must

- Permit welding only on the saddle plates, lugs, or brackets attached to the container by the manufacturer.

Anhydrous Ammonia

WAC 296-826-900

Definitions

Appurtenance

All devices that are added onto the system such as pumps, compressors, safety relief devices, liquid-level gauging devices, valves, and pressure gauges.

Capacity

The total volume of the container measured in U.S. gallons, unless otherwise specified.

Container

All vessels, tanks, cylinders or spheres used for transportation, storage or application of anhydrous ammonia.

Cylinder

A container constructed according to the United States Department of Transportation Specifications with a water capacity of 1,000 pounds or less.

Design pressure

The same as the “maximum allowable working pressure” as used in the Unfired Pressure Vessel Code.

DOT regulations

The Department of Transportation (DOT) Hazardous Materials Regulations and Specifications for Shipping Containers found in

–Title 49--Transportation, Code of Federal Regulations, Parts 171 to 190, inclusive.

Filling density

The ratio of the weight of the gas in a container to the weight of water at 60°F that the container will hold. One pound H_2O = 27.737 cu. in. at 60°F.

–For determining the weight capacity of the tank in pounds, the weight of a gallon (231 cubic inches) of water at 60°F in air is 8.32828 pounds.

Anhydrous Ammonia

WAC 296-826-900

Definitions

Gas

Anhydrous ammonia in either the gaseous or liquefied state.

Hydrostatic relief valve

An automatic pressure activated valve for liquid service

- It's characterized by a throttle or slow weep opening, a nonpop action.
- Refer to American National Standards Institute, Terminology for Pressure Relief Devices, B95.1 for more information.

"psig" and "psia"

Abbreviations that mean the following

- "psig" refers to pounds per square inch gauge
- "psia" refers to absolute pounds per square inch.

Safety relief valve

An automatic spring loaded or equivalent type pressure activated device for gas or vapor service.

- It's characterized by a pop action upon opening, and is sometimes referred to as a pop valve.
- Refer to American National Standards Institute, Terminology for Pressure Relief Devices, B95.1 for more information.

Semi-trailer

Every vehicle that meets both of the following

- Designed for carrying property and for being drawn by a motor vehicle
- Constructed so that some part of its weight and the weight of its load rests upon or is carried by another vehicle.

Anhydrous Ammonia

WAC 296-826-900

Definitions

Systems

An assembly of equipment consisting of the container or containers, appurtenances, pumps, compressors, and interconnecting piping.

Tank motor vehicle

Any motor vehicle designed or used for the transportation of anhydrous ammonia that has either

– A tank designed to be permanently attached to any motor vehicle

or

– A container that isn't permanently attached but needs to be loaded and unloaded without being removed from the motor vehicle due to its size, construction, or means of attachment.

Trailer

Every vehicle meeting all of the following

– Designed for carrying property and for being drawn by a motor vehicle

– Constructed so that no part of its weight except the towing device rests on the towing vehicle.

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Anhydrous Ammonia

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Statutory Authority

296-826-100 Scope.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-100, filed 05/02/06, effective 09/01/06]

296-826-200 Employee safety.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-200, filed 05/02/06, effective 09/01/06]

296-826-20005 Personal protective equipment.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-20005, filed 05/02/06, effective 09/01/06]

296-826-20010 Training.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-20010, filed 05/02/06, effective 09/01/06]

296-826-20015 Chemical reactions.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-20015, filed 05/02/06, effective 09/01/06]

296-826-20020 Emergencies.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-20020, filed 05/02/06, effective 09/01/06]

296-826-300 Design, construction and installation.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-300, filed 05/02/06, effective 09/01/06]

296-826-30005 General specifications.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-30005, filed 05/02/06, effective 09/01/06]

296-826-30010 Specifications for portable DOT containers.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-30010, filed 05/02/06, effective 09/01/06]

296-826-30015 Nonrefrigerated stationary containers.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-30015, filed 05/02/06, effective 09/01/06]

296-826-30020 Refrigerated storage.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-30020, filed 05/02/06, effective 09/01/06]

296-826-30025 Systems mounted on trucks, semi-trailers, and trailers.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-30025, filed 05/02/06, effective 09/01/06]

296-826-30030 Systems mounted on farm trucks or trailers for transporting ammonia.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-30030, filed 05/02/06, effective 09/01/06]

296-826-30035 Systems mounted on farm equipment for ammonia application.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-30035, filed 05/02/06, effective 09/01/06]

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296-826-30040 DOT containers.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-30040, filed 05/02/06, effective 09/01/06]

296-826-30045 Installation.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-30045, filed 05/02/06, effective 09/01/06]

296-826-30050 Reinstallation.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-30050, filed 05/02/06, effective 09/01/06]

296-826-30055 Installation.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-30055, filed 05/02/06, effective 09/01/06]

296-826-30060 Reinstallation.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-30060, filed 05/02/06, effective 09/01/06]

296-826-400 Equipment and systems.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-400, filed 05/02/06, effective 09/01/06]

296-826-40005 Electrical.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-40005, filed 05/02/06, effective 09/01/06]

296-826-40010 Hose specifications.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-40010, filed 05/02/06, effective 09/01/06]

296-826-40015 General requirements for all systems.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-40015, filed 05/02/06, effective 09/01/06]

296-826-40020 Nonrefrigerated systems.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-40020, filed 05/02/06, effective 09/01/06]

296-826-40025 Systems mounted on trucks, semi-trailers, and trailers.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-40025, filed 05/02/06, effective 09/01/06]

296-826-40030 Refrigerated storage compressors.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-40030, filed 05/02/06, effective 09/01/06]

296-826-40035 Refrigeration load.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-40035, filed 05/02/06, effective 09/01/06]

Statutory Authority

296-826-40040 Separators for refrigerated storage.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-40040, filed 05/02/06, effective 09/01/06]

296-826-40045 Automatic control equipment for refrigerated storage.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-40045, filed 05/02/06, effective 09/01/06]

296-826-40050 Other refrigerated storage equipment.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-40050, filed 05/02/06, effective 09/01/06]

296-826-40055 Compressors for refrigerated systems.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-40055, filed 05/02/06, effective 09/01/06]

296-826-500 Appurtenances.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-500, filed 05/02/06, effective 09/01/06]

296-826-50005 Appurtenance requirements for all systems.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-50005, filed 05/02/06, effective 09/01/06]

296-826-50010 Nonrefrigerated stationary containers.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-50010, filed 05/02/06, effective 09/01/06]

296-826-50015. Refrigerated tanks.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-50015, filed 05/02/06, effective 09/01/06]

296-826-50020 Systems mounted on trucks, semi-trailers, and trailers.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-50020, filed 05/02/06, effective 09/01/06]

296-826-50025 Systems mounted on farm trucks or trailers for transportation of ammonia.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-50025, filed 05/02/06, effective 09/01/06]

296-826-50030 Systems mounted on farm equipment for ammonia transportation.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-50030, filed 05/02/06, effective 09/01/06]

296-826-50035 Portable DOT containers.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-50035, filed 05/02/06, effective 09/01/06]

296-826-600 Operations.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-600, filed 05/02/06, effective 09/01/06]

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296-826-60005 Mounting containers on trucks, semi-trailers and trailers.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-60005, filed 05/02/06, effective 09/01/06]

296-826-60010 Mounting containers on farm trucks or trailers for transporting ammonia.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-60010, filed 05/02/06, effective 09/01/06]

296-826-60015 Tank car loading and unloading.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-60015, filed 05/02/06, effective 09/01/06]

296-826-60020 General specifications.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-60020, filed 05/02/06, effective 09/01/06]

296-826-60025 Additional requirements for systems mounted on trucks, semi-trailers, and trailers for transporting ammonia.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-60025, filed 05/02/06, effective 09/01/06]

296-826-60030 Nonrefrigerated containers.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-60030, filed 05/02/06, effective 09/01/06]

296-826-60035 Refrigerated tanks.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-60035, filed 05/02/06, effective 09/01/06]

296-826-60040 Welding.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-60040, filed 05/02/06, effective 09/01/06]

296-826-900 Definitions.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 06-10-067 (Order 06-04), § 296-826-900, filed 05/02/06, effective 09/01/06]